PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : A61N 5/01, 5/06 — A1

(11) International Publication Number: **WO 00/43067**

(43) International Publication Date: 27 July 2000 (27.07.00)

(21) International Application Number: PCT/SE00/00106

(22) International Filing Date: 19 January 2000 (19.01.00)

(30) Priority Data:
9900159-6 20 January 1999 (20.01.99) SE

(71) Applicant *(for all designated States except US)*: BIOLIGHT PATENT HOLDING AB [SE/SE]; Svärdvägen 15, S-182 33 Danderyd (SE).

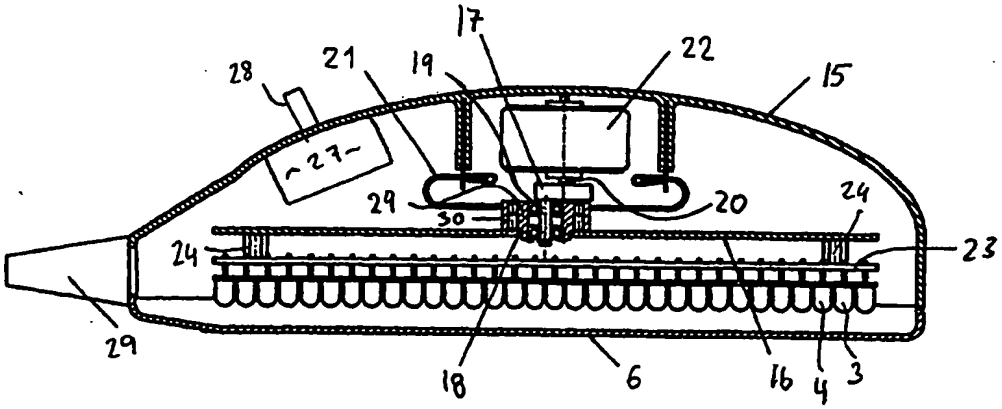
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: THIBERG, Rolf [SE/SE]; Åkersbergavägen 10, S-184 50 Åkersberga (SE).

(74) Agents: ÖRTENBLAD, Bertil et al.; Norén Patentbyrå AB, Box 10198, S-100 55 Stockholm (SE).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
In English translation (filed in Swedish).

(54) Title: LIGHT EMITTING MEANS FOR EXTERNAL MEDICAL TREATMENT WITH LIGHT



(57) Abstract

Apparatus for external medical treatment with the aid of light, said apparatus comprising a light emitting device (1) which is intended to be held against or in the close proximity of a patient's body, and means (8, 9, 10) for driving the light emitting device, wherein said light emitting device includes light emitting diodes or corresponding elements designed to emit monochromatic light, wherein the drive means (8, 9, 10) is designed to control the light emitting device (1) to emit one or more types of monochromatic light over one or more predetermined time periods and to pulsate said emitted light in accordance with a predermined pulse frequency or a series of pulse frequency over said time periods, and wherein said light emitting device (1) includes a casing (15) and a plate (16) that carries said light emitting diodes. The apparatus is characterised by an eccentric arrangement which includes a first part (17) that is fixed relative to said casing (15) and a second part (18) that is connected to said plate (16); and by a spring (21) which functions to prevent rotation of the plate (16); and by an electric motor (22) which functions to drive said eccentric arrangement (17, 18), thereby causing the plate (16) carrying said light emitting diodes (3, 4) to execute an oscillatory movement.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

LIGHT EMITTING MEANS FOR EXTERNAL MEDICAL TREATMENT WITH LIGHT

The present invention relates to a light-emitting device for external medical treatment with the aid of light, more specifically with the aid of light which palliates and/or cures different states of diseases.

Swedish Patent Specification No. 502 784 for example teaches apparatus for external medical treatment with the aid of light that includes a light-emitting device which is intended to be held against or close to the body of an individual, and drive means for the light-emitting device, which device includes light emitting diodes or corresponding elements and is intended to emit infrared light. According to the aforesaid patent specification, the means for driving the light-emitting device is designed to control said device to emit infrared light in a first stage over a first predetermined time period and then to emit visible light in a second stage over a second predetermined time period, wherein said drive means is designed to pulsate the infrared light and the visible light in accordance with a predetermined series of pulse frequencies.

It is also known to emit other monochromatic light for treating different states of diseases.

It has also been found that very good results can be obtained when treating a patient with solely one or more monochromatic light and with light other than infrared light, such as visible light of different colours emitted in accordance with a given pulse frequency.

It has been found that a device of the aforesaid kind can be used very successfully for treating many different states of diseases and injuries, for instance sport sustained injuries, stretched muscles, muscular pain, joint pain, headaches, various inflammatory conditions, various skin complaints, such as acne, back pains, etc., provided that the light is emitted in a certain way. In this regard, treatment with light has a favourable influence on injury healing processes and will palliate and/or cure various diseases.

There is thus an understanding that treatment with certain light that is emitted in certain frequency series will have a significantly greater effect in shortening the time taken to cure or palliate a disease.

One problem with devices of this kind known hitherto is that the person administering the treatment is required to oscillate the light-emitting device whilst holding the device against or in the close proximity of that region of the patient's body to be treated. The reason for this is because the light emitting diodes disposed at the bottom of the light-emitting device have a certain geometric extension and are of different kinds, and hence two mutually adjacent light emitting diodes of mutually the same kind will be spaced at a certain distance apart. It is therefore necessary to move the light-emitting device forwards and backwards over the area to be treated, in order to ensure that the whole of said area will be irradiated uniformly to the best possible extent.

Because treatment of this kind will usually take from about two to ten minutes to carry out, administration of the treatment concerned may be very onerous to the person concerned.

This problem is solved by the invention.

Thus, the present invention relates to apparatus which is intended for external medical treatment with the aid of light and which includes a light emitting device that is intended to lie against or be held in the close proximity of the patient's body, and drive means for said device, wherein the light-emitting device includes light emitting diodes or corresponding elements which are designed to emit monochromatic light, wherein the means that drives said device is adapted to control the light-emitting device to emit one or more types of monochromatic light over one or more predetermined time periods and to pulsate said emitted light in accordance with a predetermined pulse frequency or series of pulse frequencies over said time periods, and wherein the light-emitting device includes a casing and a light-emitting-diode supporting plate, said apparatus being characterised by an eccentric element which includes a first part that is fixed in relation to said casing and a second part which is connected to said plate; and by a spring means which functions to prevent rotation of the plate; and by an electric motor which functions to drive said eccentric element such as to cause said plate carrying said light emitting diodes to perform an oscillatory movement.

The invention will now be described in more detail partly with reference to an exemplifying embodiment thereof shown on the accompanying drawings, in which

- Figure 1 is a schematic block diagram of an inventive apparatus;
- Figure 2 is a side view of a light emitting device;
- Figure 3 is a cross-sectional view of a light emitting device in accordance with the invention; and

- Figure 4 shows the light emitting device of Figure 3 from beneath.

Figures 1 and 2 illustrate generally an apparatus for external medical treatment with the aid of light, said apparatus including a light emitting device 1 which is intended to be held against or in the close proximity of the patient's body. The light emitting device is shown from one side in Figure 2 and from beneath in Figure 1. This device 1 includes a casing 5 which houses a transparent plate 6. Located beneath the plate 6 is a surface 2 on which a plurality of light emitting diodes 3, 4 or corresponding elements are mounted.

The light emitting diodes thus emit light through the plate 6 when energised, i.e. when supplied with current through a cable 7.

When the device is being used, the casing 5 is held so that the plate 6 will lie against the relevant part of the patient's body.

The apparatus also includes drive means for the light emitting device 1. The drive means is adapted to control the light emitting device 1 to emit different monochromatic light on different wavelengths over different predetermined time periods, and to pulsate the light emitted in accordance with a predetermined pulse frequency or series of pulse frequencies over said time periods.

The light emitting device 1 may include light emitting diodes 3 adapted for the emission of infrared light. These diodes are shown with solid circles in Figure 1. Visible light can be emitted with the aid of other light emitting diodes 4.

These diodes are illustrated with empty circles in Figure 1. The infrared light diodes 3 will preferably be semi-conductors of the GaAs-type (Gallium Arsenide). The diodes 4 that emit visible light will also preferably be of the GaAs-type.

The drive means includes a computer 8 which controls drive circuits 9, 10 to which signals for driving or operating the light emitting diodes are sent from the computer via the cable 7.

The computer and the drive circuits are of a suitable known kind. The drive means or computer has connected thereto a keyboard 13 by means of which the operator can key-in data for causing the drive means to activate the light emitting device in a desired manner. The device will conveniently include a display 14 for displaying the settings entered through the keyboard. This display may be the computer screen.

The light emitting device 1 includes light emitting diodes 4 which are adapted to emit essentially monochromatic visible light in one of the colours violet, blue, yellow, orange, red or green, and also infrared light and other invisible wavelengths.

The nature of the light used will depend on the disease or the type of injury to be treated.

A large part of the above description of the drawings is also found in the aforementioned patent specification.

According to the present invention, the light emitting device 1 includes a casing 15 and a plate 16 that carries the light emitting diodes 3, 4.

There is included, in accordance with the invention, an eccentric arrangement which has a first part 17 that is fixed in relation to the casing 15, and a second part 18 that is connected to the plate 16. The first part 17 has a trunnion 19 which is offset in relation to a drive shaft 20. The second part 18 may include a bearing 29 with associated bearing casing 30, wherewith the bearing casing is fixed in the plate 16 and the trunnion 19 is inserted into the bearing.

A spring 21 prevents rotation of the plate 16. The spring will conveniently be a flat spring that is fastened in the bearing casing of said second part 18 and fixed in relation to the casing 15.

The eccentric arrangement is driven by an electric motor 22 through the medium of the drive shaft 20.

The light emitting diodes 3, 4 are illustrated in Figure 4 by means of circles filled with a centre cross. The diodes are fastened to a carrier plate 23 which, in turn, is fastened to the plate 16 via spacer elements 24.

When the motor 22 drives the shaft 20, the plate 16 will execute an eccentric oscillatory movement instead of a rotary movement, wherewith the light emitting diodes will, of course, accompany this movement.

Figure 4 shows the plate 16 in its farthest possible position to the left of Figure 4. The neutral position of the plate

periphery in direction 25 is shown in dash-dotted lines 24 in Figure 4. The difference in the positions between the dash-dotted line 24 and the plate periphery shown in a full line in said direction 25 is equal to the eccentricity E given by the eccentric arrangement. Naturally, the plate will be displaced to a similar extent in direction 26 as the eccentric arrangement travels through a complete revolution.

According to one preferred embodiment, the eccentric arrangement has an eccentricity E of about 3 to 10 millimetres.

According to one preferred embodiment, the eccentric arrangement is driven at a speed of about 1 to 200 r.p.m. The motor 22 will conveniently be a stepping motor. The motor will also be designed for rotation in both directions.

According to another preferred embodiment, the electric motor 22 will preferably be a variable speed motor. An appropriate known control circuit 27 may be fitted to the casing 15 to this end. An outwardly projecting knob 28 may be provided for finger control of the motor speed.

The reference numeral 29 in Figure 3 identifies a cable transit for an electric cable for powering the motor and the light emitting diodes. The control circuit may be included in the drive means 8, 9, 10. In this case, the motor can be energised via said cable therewith obviating the need for a separate control circuit 27 in the light emitting device 1. The desired motor speed can be keyed-in through the keyboard 13.

It will be evident from the aforegoing that the present invention solves the aforesaid problem.

Although the invention has been described with reference to a number of exemplifying embodiments thereof it will be obvious that the constructive solutions for achieving oscillatory movement of the plate can be greatly varied by the man skilled in the art.

It will therefore be understood that the present invention is not restricted by the aforedescribed embodiments but that modifications and variations can be made within the scope of the accompanying Claims.

CLAIMS

1. Apparatus for external medical treatment with the aid of light, said apparatus comprising a light emitting device (1) which is intended to be held against or in the close proximity of a patient's body, and means (8, 9, 10) for driving the light emitting device, wherein said light emitting device includes light emitting diodes or corresponding elements designed to emit monochromatic light, wherein the drive means (8, 9, 10) is designed to control the light emitting device (1) to emit one or more types of monochromatic light over one or more predetermined time periods and to pulsate said emitted light in accordance with a predetermined pulse frequency or a series of pulse frequency over said time periods, and wherein said light emitting device (1) includes a casing (15) and a plate (16) that carries said light emitting diodes, **characterised** by an eccentric arrangement which includes a first part (17) that is fixed relative to said casing (15) and a second part (18) that is connected to said plate (16); and by a spring (21) which functions to prevent rotation of the plate (16); and by an electric motor (22) which functions to drive said eccentric arrangement (17, 18), thereby causing the plate (16) carrying said light emitting diodes (3, 4) to execute an oscillatory movement.

2. Apparatus according to Claim 1, **characterised** in that the eccentric arrangement (17, 18) has an eccentricity of about 3 to 10 millimetres.

3. Apparatus according to Claim 1 or 2, **characterised** in that the eccentric arrangement (17, 18) is driven at a speed of about 1 to 200 rpm.

4. Apparatus according to Claim 1, 2 or 3, **characterised** in that the electric motor (22) is a variable speed motor.

Fig. 1

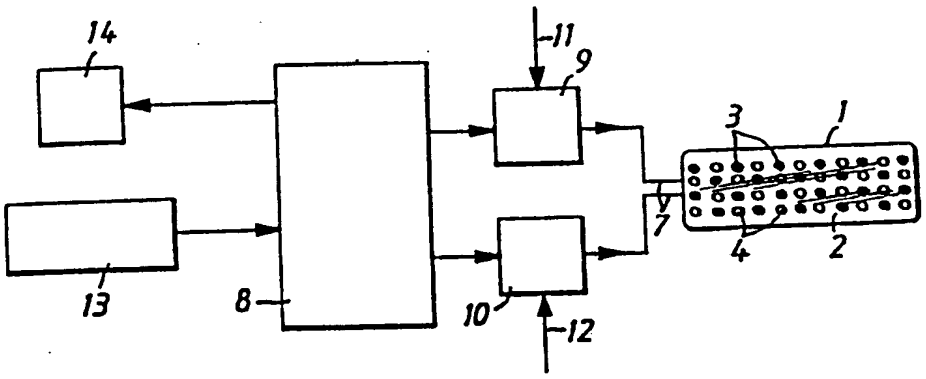


Fig. 2

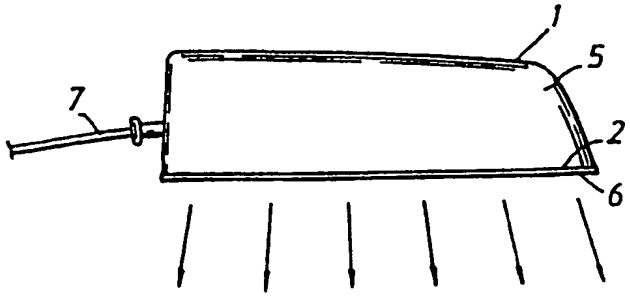


Fig 3

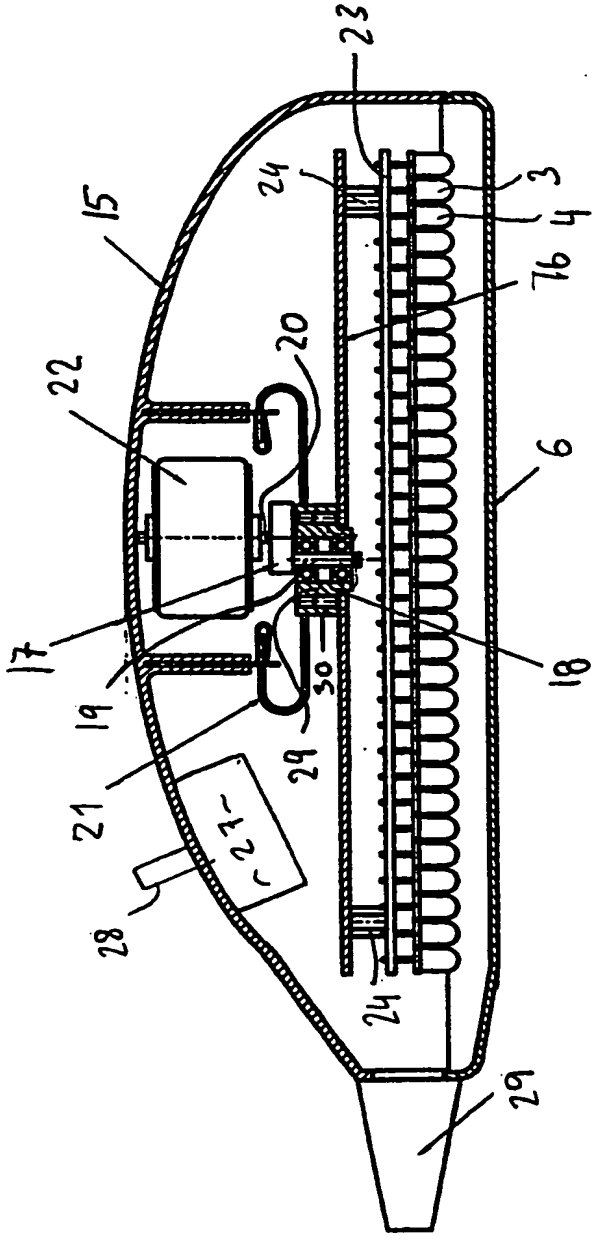
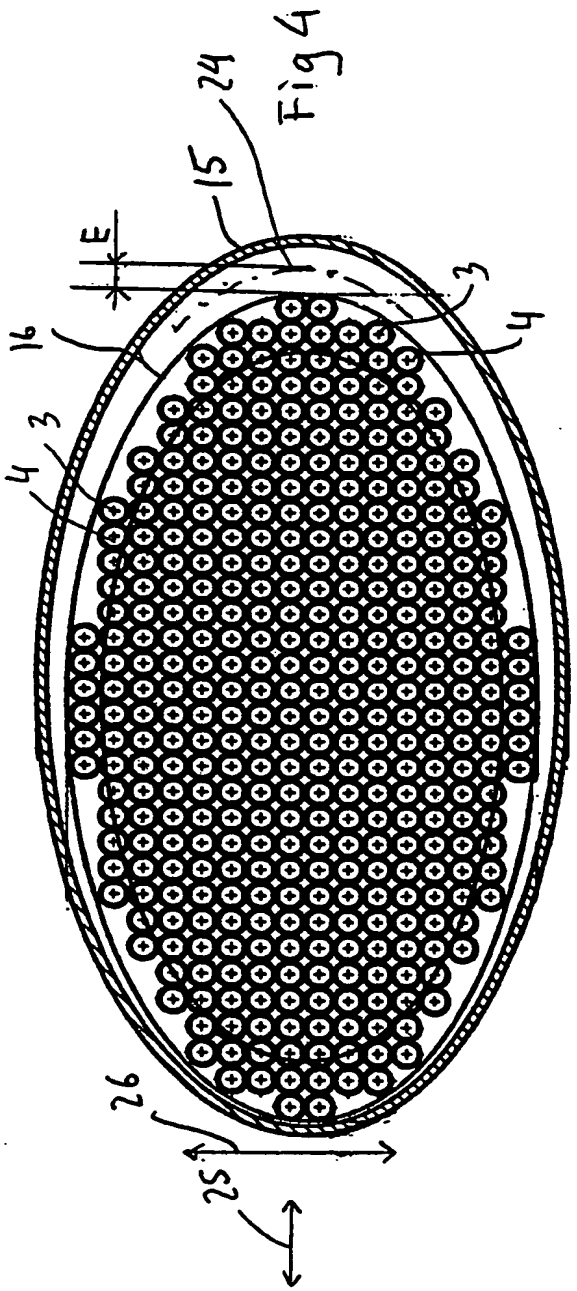

23
24
15
3
4
76
20
22
6
17
18
19
30
29
21
27
28
24
29

Fig 4


24
15
E
3
4
16
4
3
26
25

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00106

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61N 5/01, A61N 5/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SE 502784 C2 (BIOLIGHT PATENT HOLDING AB), 15 January 1996 (15.01.96), figure 1, abstract --	1-4
A	FR 2731357 A1 (STE FRANCAISE DES TECHNOLOGIES ROBOTIQUES SOCIETE A RESPONSABILITE LIMITEE), 13 Sept 1996 (13.09.96), see the whole document --	1-4
A	US 5860968 A (S.E. WOJCIK ET AL.), 19 January 1999 (19.01.99), figure 2, abstract --	1-4
A	AT 305489 B (LEOPOLD HASAN), 26 February 1973 (26.02.73), see the whole document --	1-4

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 May 2000	26 -05- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Nikolaj Hautaviita/AE Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE 00/00106

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 502784 C2	15/01/96	AU 1549595 A	08/08/95
		CA 2181345 A	27/07/95
		CN 1138830 A	25/12/96
		EP 0740568 A	06/11/96
		JP 9508032 T	19/08/97
		SE 9402679 A	21/07/95
		US 5800479 A	01/09/98
		WO 9519810 A	27/07/95
		AU 1549495 A	08/08/95
		AU 6160094 A	14/09/94
		BR 9406091 A	12/12/95
		CA 2181346 A	27/07/95
		CN 1138831 A	25/12/96
		EP 0686145 A	13/12/95
		EP 0740567 A	06/11/96
		FI 954017 A	25/08/95
		JP 8509468 T	08/10/96
		JP 9508031 T	19/08/97
		NO 953333 A	24/08/95
		PL 310399 A	11/12/95
		SE 504298 C	23/12/96
		SE 9400153 A	21/07/95
		SK 97095 A	01/10/96
		US 5766233 A	16/06/98
		US 5883129 A	16/03/99
		WO 9519809 A	27/07/95
FR 2731357 A1	13/09/96	NONE	
US 5860968 A	19/01/99	DE 19681641 T	15/10/98
		EP 0955918 A	17/11/99
		GB 2322560 A,B	02/09/98
		GB 9808691 D	00/00/00
		WO 9716126 A	09/05/97
AT 305489 B	26/02/73	NONE	